

PRELIMINARY DATA SUMMARY

September 1986

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

PRELIMINARY DATA SUMMARY

CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

CONTENTS

		Page
	COVER	
	TITLE PAGE	
	TABLE OF CONTENTS	1
I	INTRODUCTION	2
II	METEOROLOGICAL DATA	6
III	WAVE DATA	9
IV	CURRENT DATA	14
V	SUPPLEMENTAL OBSERVATIONS	20
VI	WATER LEVELS	22
VII	NEARSHORE PROFILES AND BATHYMETRY	25
VIII	SPECIAL EVENTS	28

FIGURES

1	LOCATION MAP	3
2	INSTRUMENT LOCATIONS	5
3	TIME HISTORY OF WAVE HEIGHTS AND PERIODS	12
4	WATER LEVEL TIME HISTORY	23
5	CRAB PROFILES	25
6	CRAB PROFILE ENVELOPE	26
7	FRF CONTOUR DIAGRAM	27

TABLES

1	INSTRUMENT STATUS/DATA AVAILABILITY	4
2	METEOROLOGICAL DATA	7
3	WAVE DATA	10
4	CURRENT DATA	15
5	SUPPLEMENTAL OBSERVATIONS	21
6	TIDAL CHARACTERISTICS	24

I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

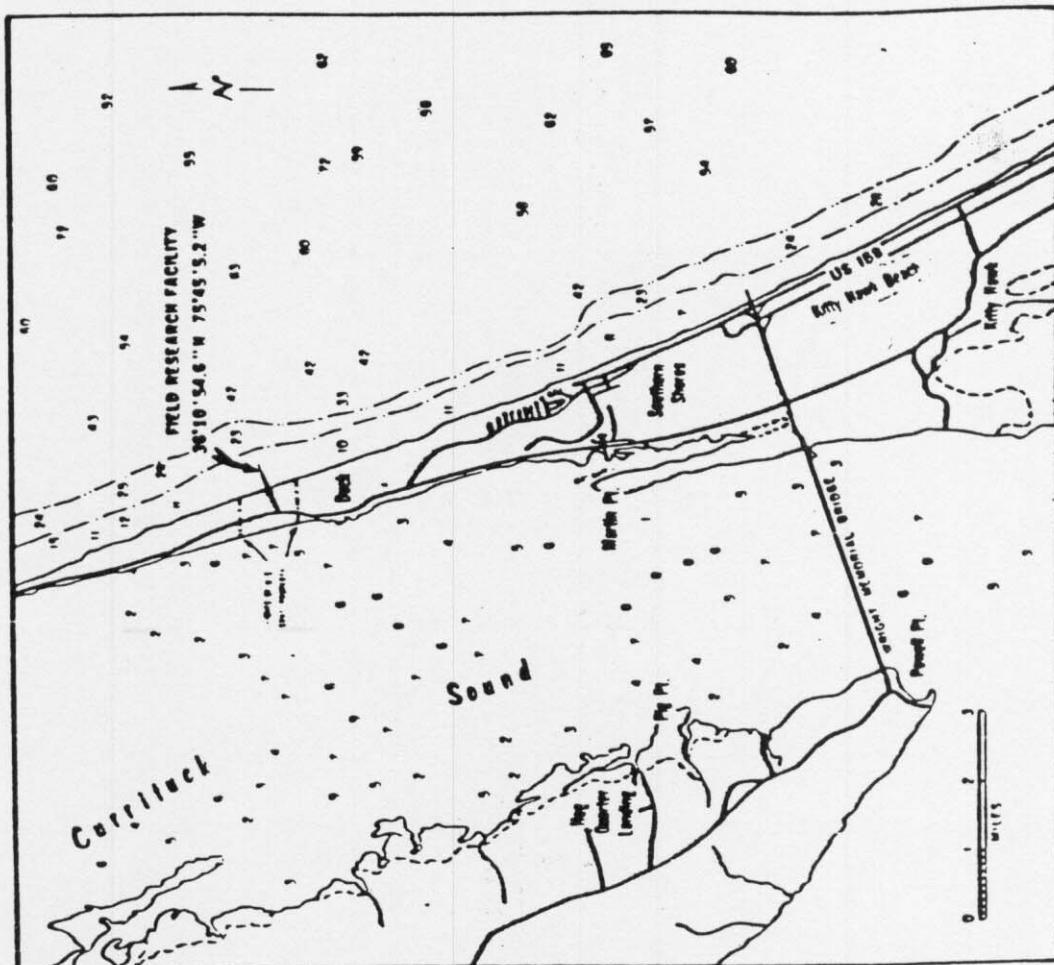
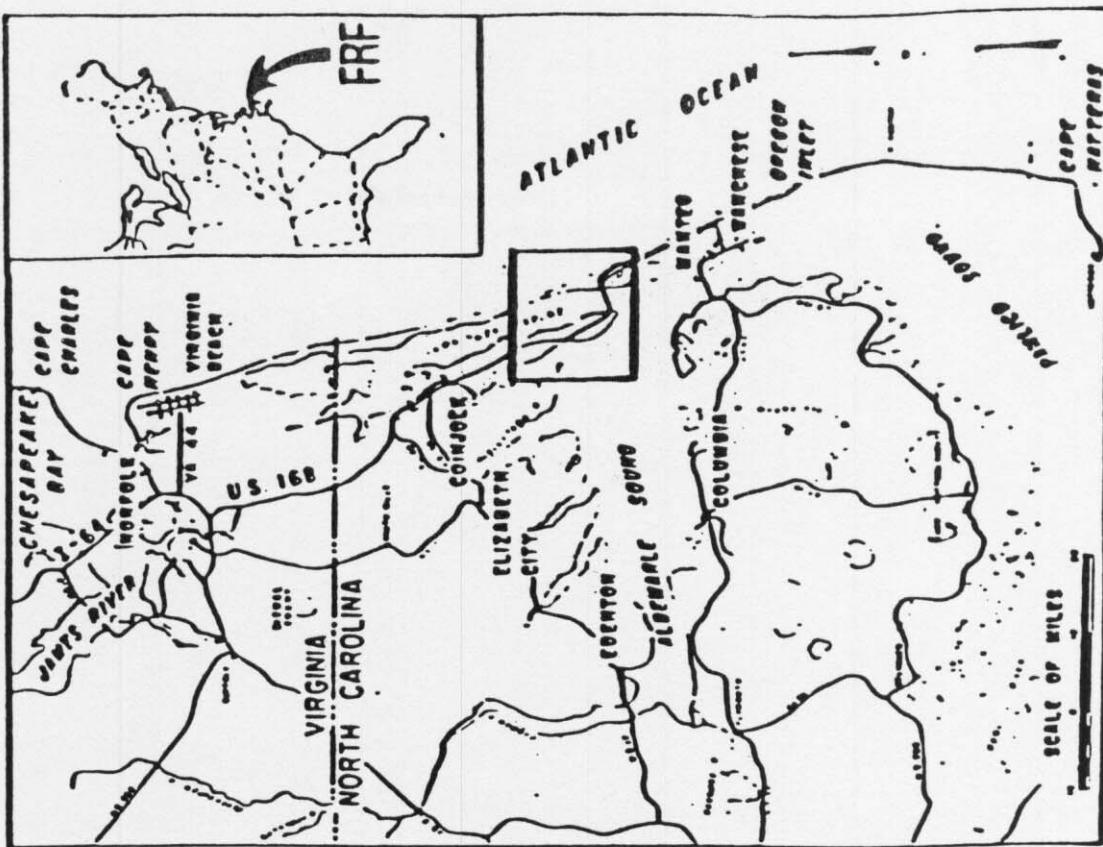


Figure 1. FRF Location Map

GAGE NUMBER	DESCRIPTION/REMARKS	DEPTH AT SENSOR	DAY OF THE MONTH									
			1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/									
	Barometric Pressure		Instrument Status	■	■	■	■	■	■	■	■	■
	Analog Record		Data Collected	■	■	■	■	■	■	■	■	■
	Instrument Status		Instrument Status	■	■	■	■	■	■	■	■	■
	Data Collected		Data Collected	■	■	■	■	■	■	■	■	■
	Analog Record		Analog Record	■	■	■	■	■	■	■	■	■
	Instrument Status		Instrument Status	■	■	■	■	■	■	■	■	■
	Data Collected		Data Collected	■	■	■	■	■	■	■	■	■
	Maximum/Minimum		Maximum/Minimum	■	■	■	■	■	■	■	■	■
	Instrument Status		Instrument Status	■	■	■	■	■	■	■	■	■
	Data Collected		Data Collected	■	■	■	■	■	■	■	■	■
	Analog Record		Analog Record	■	■	■	■	■	■	■	■	■
	Instrument Status		Instrument Status	■	■	■	■	■	■	■	■	■
	Data Collected		Data Collected	■	■	■	■	■	■	■	■	■
	Air Temperature		Air Temperature	■	■	■	■	■	■	■	■	■
	Anemometer on Lab Bldg -		Anemometer on Lab Bldg -	■	■	■	■	■	■	■	■	■
	Elevation 19m (MSL)		Elevation 19m (MSL)	■	■	■	■	■	■	■	■	■
	Baylor staff located at station 7480 on FRP pier	See profile data	Baylor staff located at station 7480 on FRP pier	■	■	■	■	■	■	■	■	■
645	Baylor staff located at station 19400 on FRP pier	See profile data	Baylor staff located at station 19400 on FRP pier	■	■	■	■	■	■	■	■	■
655	Waverider buoy located 1.0 km from shore	Approx. 8.5 m MSL	Waverider buoy located 1.0 km from shore	■	■	■	■	■	■	■	■	■
640	Waverider buoy located 6.0km from shore	Approx. 18 m MSL	Waverider buoy located 6.0km from shore	■	■	■	■	■	■	■	■	■
630	Current meter 500m south (0.5 km offshore)	Approx. 6 m MSL	Current meter 500m south (0.5 km offshore)	■	■	■	■	■	■	■	■	■
679	NOAA primary tide station located at seaward end of Pier.	Instrument Status Data Collected	NOAA primary tide station located at seaward end of Pier.	■	■	■	■	■	■	■	■	■
865-1370		Instrument Status Data Collected		■	■	■	■	■	■	■	■	■

Instrument Status: Operational ■ - Daily Observation: YES ■ , PARTIAL □
 Analog Record: ALL ■ , PARTIAL □
 Data Collected: ALL ■ , SOME □ , Preliminary Analysis: ALL ■ , SOME □

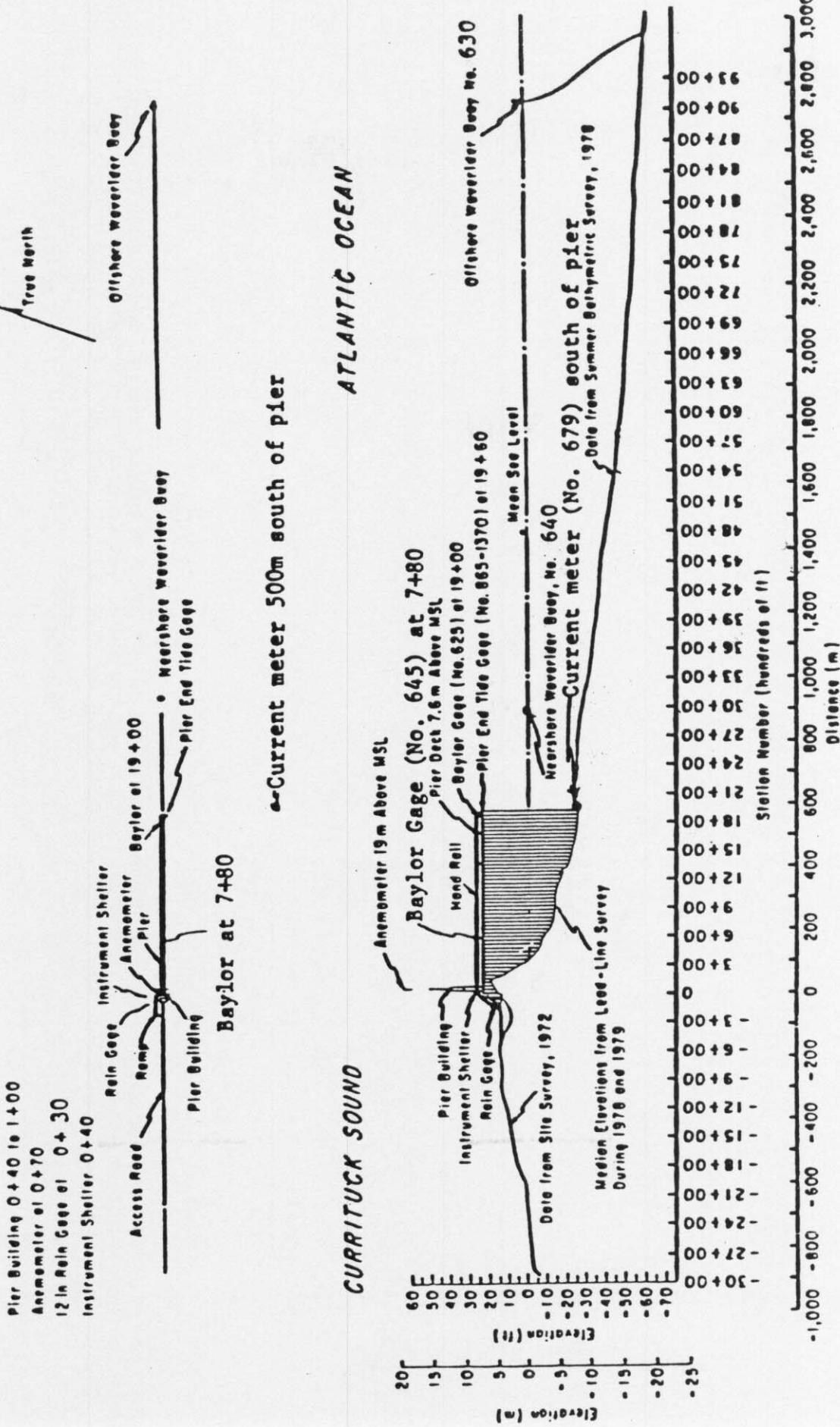


Figure 2. Instrument locations at FRF.

II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Data General NOVA-4 computer. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
 $mm \times .03937 = in$
2. Millibars (mb) to inches of mercury (in Hg) -
 $mb \times 0.02953 = in Hg$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

TABLE 2: METEOROLOGICAL DATA

PART 1

SEPTEMBER 1956

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
1	100	7	62		1023.6	0
	700	7	67		1023.6	0
	1300	6	63		1023.6	0
	1900	8	65		1022.2	0
2	100	7	77		1021.6	0
	700	7	61		1022.2	0
	1300	5	74		1022.2	0
	1900	8	75		1021.9	0
3	100	7	74	Inoperative	1021.2	0
	700	5	86		1021.9	0
	1300	7	60		1021.9	0
	1900	7	51		1020.5	0
4	100	7	57	Gage	1019.5	0
	700	8	35		1019.9	0
	1300	5	8	24.9	1018.8	0
	1900	6	55	22.2	1017.2	0
5	100	2	83	21.6	1017.2	0
	700	0		22.8	1016.3	0
	1300	4	231	24.9	1015.1	0
	1900	3	133	23.1	1014.4	0
6	100	2	243	22.7	1013.8	0
	700	3	34	22.9	1014.0	0
	1300	3	103	26.7	1014.2	0
	1900	3	79	23.9	1013.6	0
7	100	3	342	22.3	1014.4	0
	700	8	17	22.9	1015.7	0
	1300	6	24	25.0	1015.7	0
	1900	4	65	23.1	1017.6	0
8	100	5	107	22.6	1013.4	0
	700	4	331	22.1	1020.3	0
	1300	11	14	19.9	1021.9	0
	1900	7	34	19.7	1022.7	0
9	100	6	30	19.3	1024.2	0
	700	8	45	20.1	1025.1	0
	1300	5	48	21.3	1027.2	0
	1900	5	75	20.8	1026.0	0
10	100	3	84	20.7	1026.4	0
	700	5	96	22.1	1027.1	0
	1300	4	134	25.4	1026.0	0
	1900	4	166	22.7	1024.3	0
11	100	4	180	22.5	1023.0	0
	700	3	196	24.0	1023.4	0
	1300	6	185	29.2	1020.7	0
	1900	5	183	25.4	1018.0	9
12	100	7	211	24.3	1016.4	0
	700	7	224	24.4	1014.4	0
	1300	8	236	30.1	1012.3	0
	1900	4	215	24.6	1013.5	9
13	100	5	326	23.6	1014.5	24
	700	12	24	22.2	1018.8	0
	1300	9	15	22.1	1020.6	0
	1900	7	14	20.7	1021.3	0
14	100	6	22	20.9	1022.2	0
	700	4	342	20.9	1024.3	0
	1300	7	33	23.2	1025.3	0
	1900	6	78	21.1	1025.3	0
15	100	4	117	21.1	1025.8	0
	700	4	131	22.6	1026.7	0
	1300	7	135	25.1	1025.3	0
	1900	4	174	22.1	1023.6	0
16	100	6	203	22.5	1021.1	0
	700	8	239	22.4	1020.9	0
	1300	14	32	21.3	1021.8	0
	1900	9	39	18.7	1023.9	0

TABLE 2: METEOROLOGICAL DATA

PART 2

SEPTEMBER 1986

		WIND SPEED DAY HOUR	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
17	100	9	38	18.6	1025.8	0
	700	10	26	17.5	1029.2	0
	1300	8	19	18.7	1028.5	0
	1900	7	65	18.2	1023.0	0
18	100	2	112	18.6	1028.7	0
	700	5	78	19.7	1028.7	0
	1300	4	102	23.5	1027.0	0
	1900				1023.6	0
19	100		Operator Error		1023.9	0
	700	5	221	21.4	1024.6	0
	1300	4	250	24.8	1022.6	0
	1900	2	172	22.8	1022.2	0
20	100	3	240	21.5	1021.8	0
	700	2	11	21.6	1023.1	0
	1300	5	101	24.4	1022.5	0
	1900	3	115	22.3	1021.5	0
21	100	5	120	21.7	1021.4	0
	700	3	117	22.3	1021.7	0
	1300	3	100	26.9	1021.4	0
	1900	3	99	23.1	1020.7	0
22	100	7	51	22.5	1021.7	0
	700	7	57	21.4	1022.7	0
	1300	5	54	22.3	1023.0	0
	1900	6	81	20.9	1020.9	0
23	100	1	141	18.4	1019.9	0
	700	7	241	23.2	1014.4	0
	1300	5	245	28.4	1013.4	0
	1900				1011.7	0
24	100		Disk Crash		1012.4	0
	700	7	241	23.2	1014.4	0
	1300	4	191	28.1	1015.8	0
	1900	4	249	25.8	1013.8	0
25	100	4	252	24.6	1015.1	0
	700	6	255	24.1	1017.3	0
	1300	4	244	29.8	1017.5	0
	1900	2	124	25.8	1018.8	0
26	100	3	260	25.4	1019.9	0
	700	3	255	25.3	1021.0	0
	1300	3	127	29.9	1019.1	0
	1900	3	183	28.4	1017.4	0
27	100	6	242	25.9	1016.7	0
	700	5	263	25.5	1016.8	0
	1300	6	15	27.0	1016.8	0
	1900	2	80	24.3	1018.0	0
28	100	8	34	22.6	1019.3	0
	700	9	54	22.4	1021.9	0
	1300	7	45	23.0	1023.7	0
	1900	6	32	22.3	1024.5	0
29	100	5	71	22.5	1024.3	0
	700	4	102	23.6	1026.2	0
	1300	6	127	28.1	1025.8	0
	1900	3	170	23.3	1025.1	0
30	100	3	198	23.6	1025.1	0
	700	4	234	24.2	1024.8	0
	1300	4	220	29.4	1022.2	0
	1900	4	204	27.0	1020.5	0

III. WAVE DATA

Wave data were collected from two Baylor staff gages (CERC gage Nos. 625 and 645) and Waverider buoys (CERC gage Nos. 630 and 640, Table 1 and Figure 2). The data were collected, analyzed, and stored on magnetic tape using a Data General NOVA-4 computer.

The NOVA-4 is programmed to sample the wave gages every 6 hours near 0100, 0700, 1300, and 1900 EST at a sampling rate of four times per second, collecting data in 20- minute records.

Wave height (H_{mo}) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. The wave period is identified from the computation of a variance (energy) spectrum using a Fast Fourier Transform of 4096 data points (1024 sec). The period (T_p) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape and entered into the CERC data base.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means shown in Table 3 are an average of the values computed for all data records collected. The monthly standard deviations are standard deviations from the monthly mean of values for each record.

Figure 3 is a time history of the H_{mo} and T_p values for the Waveriders, 6 km from shore (630) and 1 km from shore (640).

Differences in wave periods between wave gages (Table 4 and Figure 3) may be due to wave breaking or reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

PART 1

SEPTEMBER 1986

GAGE		645		625		640		630	
DAY	TIME	Baylor at 7180 Hmo(m)	T(sec)	Baylor at 19400 Hmo(m)	T(sec)	Nearshi Wvrdt Hmo(m)	T(sec)	Father Wvrdt Hmo(m)	T(sec)
1	1	.84	5.63			1.08	7.42	1.28	6.40
	7	.68	6.40			1.00	8.83	1.07	6.40
	13	.64	5.02			.94	7.42	1.01	8.06
	19	.64	8.06			.85	8.06	.97	8.06
2	1	.57	3.15			.87	6.87	1.02	5.99
	7	.60	2.95			.86	8.83	.99	8.06
	13	.63	8.83			.88	8.83	.97	6.87
	19	.64	6.40			.95	8.06	1.09	8.83
3	1	.67	7.42			.99	6.87	1.08	7.42
	7	.63	5.31			.93	7.42	1.14	6.87
	13	.66	5.63			.89	8.06	.98	6.87
	19	.77	6.87			1.03	5.02	1.17	6.40
4	1	.89	4.53			1.05	5.63	1.11	6.40
	7	.98	8.83			1.21	8.06	1.42	8.06
	13	.82	8.83			1.19	8.83	1.17	8.06
	19	.69	7.42			*		*	
5	1	.52	7.42			*		*	
	7	.58	6.87						
	13	.80	6.87			.91	7.42	1.07	6.40
	19	.54	12.34			.86	8.06	.94	8.83
6	1	.66	6.40			.91	8.83	.94	8.83
	7	.52	6.40			.86	8.06	.87	8.06
	13	.36	10.89			.91	8.06	.93	8.06
	19	.45	9.75			.78	8.06	.86	8.83
7	1	.38	8.83			.72	8.06	.75	8.06
	7	.49	8.06			.90	8.83	.92	8.83
	13	.49	8.83			*		.78	9.75
	19	.55	8.83			.73	9.75	.82	8.83
8	1	.41	9.75			.68	8.83	.78	8.83
	7	.42	8.06			.77	8.83	.70	8.83
	13	.93	5.02			1.07	5.02	1.23	5.02
	19	.79	4.76			.92	5.63	1.09	5.31
9	1	.61	5.31			*		*	
	7	.61	4.32			.85	4.13	.85	6.40
	13	.49	5.31			*		*	
	19	.48	3.51						
10	1	.37	6.87			.62	7.42	.70	7.42
	7	.38	10.89			.56	8.06	.68	8.06
	13	.43	8.06			*		*	
	19	.46	2.86			.48	7.42	.62	6.87
11	1	.33	6.40			.58	6.87	.63	6.87
	7	.30	5.63			.44	9.75	.51	7.42
	13	.38	5.63			.51	8.83	.52	8.83
	19	.52	2.86			.55	5.99	.63	6.87
12	1	.45	5.31			.47	10.89	.64	3.51
	7	.55	5.63			.54	8.83	.68	9.75
	13	.48	8.83			.54	9.75	.70	8.06
	19	.42	6.40			.57	6.87	.71	5.31
13	1	.37	5.99			.46	8.83	.65	6.40
	7	1.12	5.02			.43	8.83	.53	6.06
	13	.90	5.63			1.24	5.02	1.48	4.53
	19	.67	5.63			1.18	5.63	1.36	5.63
14	1	.60	4.76			.91	5.99	1.08	5.63
	7	.48	5.02			.84	5.63	.99	5.99
	13	.64	10.89			.76	9.75	.89	5.31
	19	.74	9.75			.86	9.75	.94	9.75
15	1	.74	9.75			.99	10.89	1.13	9.75
	7	.68	9.75	.90	9.75	1.03	9.75	1.22	9.75
	13	.76	8.83	.86	9.75	.97	9.75	1.08	10.89
	19	.58	8.83	.74	10.89	.88	9.75	.94	9.75
16	1	.72	10.89			.94	9.75	1.00	10.89
	7	.44	10.89			.85	10.89	.81	9.75
	13	.87	4.13			.69	9.75	.70	10.89
	19	1.16	6.40			1.04	3.79	1.09	3.95
						1.66	6.40	1.78	6.87

Gage Inoperative

*=Electronic problems

TABLE 3: WAVL DATA

PART 2

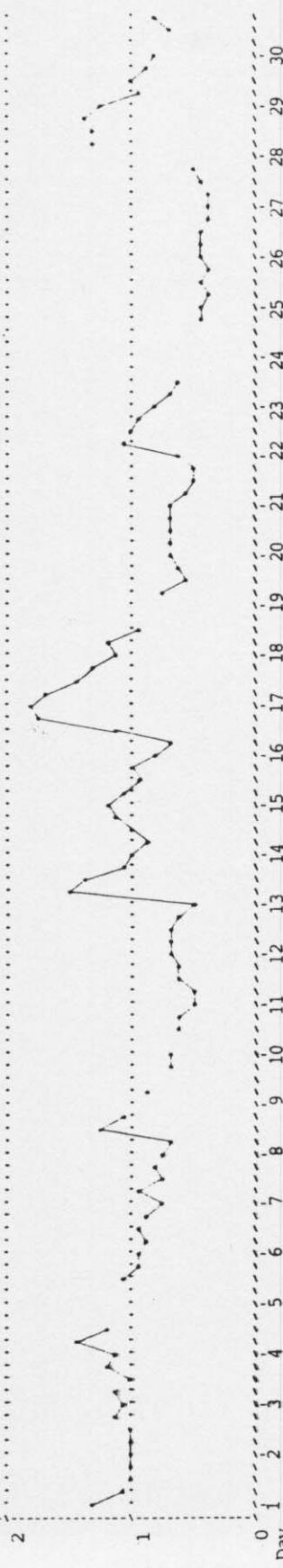
SEPTEMBER 1986

GAGE		645		625		640		630	
DAY	TIME	Baylor at 7+00 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearshtr Wvrdt Hmo(m)	T(sec)	Farsht Wvrdt Hmo(m)	T(sec)
17	1	1.25	5.63			1.56	8.06	1.81	6.87
	7	1.12	6.40			1.54	5.99	1.70	5.99
	13	1.10	4.76			1.25	7.42	1.46	6.87
	19	.80	5.63			1.18	4.53	1.33	6.40
18	1	.82	5.63			.95	7.42	1.13	6.87
	7	.72	6.40			.99	8.83	1.18	8.83
	13	.86	9.75	.88	9.75	.93	9.75	.92	8.83
	19			Operator Error					
	7	.41	9.75	.65	9.75	.64	8.83	.78	9.75
	13	.47	12.34	.53	12.34	.51	12.34	.58	8.06
	19	.44	12.34	.56	12.34	.57	8.06	.63	12.34
20	1	.47	12.34	.57	10.89	.60	10.89	.68	12.34
	7	.38	12.34	.54	12.34	.61	9.75	.68	10.89
	13	.50	12.34	.62	12.34	.58	10.89	.67	12.34
	19	.40	10.89	.54	10.89	.68	9.75	.68	10.89
21	1	.44	12.34	.55	12.34	.59	10.89	.67	10.89
	7	.44	9.75	.57	9.75	.55	12.34	.58	10.89
	13	.28	12.34	.54	12.34	.52	14.22	.53	10.89
	19	.35	12.34	.47	10.89	.44	12.34	.52	12.34
22	1			.61	12.34	.58	10.89	.62	10.89
	7	.73	4.31	.92	4.13	.92	10.89	1.09	4.13
	13	.73	5.63	.66	5.02	.87	4.76	1.01	5.99
	19	.57	6.40	.84	6.87	.95	9.75	.95	5.63
23	1	.45	5.63	.63	6.40	.72	6.87	.80	6.87
	7	.36	9.75	.57	5.99	.61	6.87	.68	6.87
	13	.31	10.89	.49	9.75	.58	6.40	.62	10.89
	19			Disk Error					
24	1								
	7								
	13								
	19	.22	12.34	.37	9.75	.41	9.75	.46	9.75
25	1	.26	10.89	.32	12.34	.35	9.75	.42	9.75
	7	.18	14.22	.30	9.75	.31	12.34	.38	9.75
	13	.26	12.34	.33	12.34	.34	12.34	.41	12.34
	19	.19	8.83	.33	12.34	.35	12.34	.39	9.75
26	1	.26	8.83	.32	12.34	.35	10.89	.45	12.34
	7	.20	9.75	.34	10.89	.34	8.83	.42	12.34
	13	.24	8.83	.35	10.89	.35	10.89	.43	8.83
	19	.17	8.83	.30	10.89	.35	8.06	.40	8.83
27	1	.23	16.79	.33	16.79	.35	16.79	.40	9.75
	7	.16	14.22	.27	9.75	.34	10.89	.40	9.75
	13	*		.44	14.22	.43	12.34	.45	9.75
	19	.30	14.22	.42	14.22	.45	12.34	.50	14.22
28	1	*		.60	14.22	.61	14.22	*	
	7	.87	5.31	1.14	8.06	1.28	8.06	1.34	8.06
	13	.74	10.89	1.16	10.89	1.19	10.89	1.32	8.06
	19	.77	8.06	1.17	7.42	1.21	7.42	1.36	7.42
29	1	.77	8.06	1.10	6.87	1.11	6.87	1.24	6.87
	7	.68	5.31	.86	9.75	.88	7.42	.93	8.83
	13	.64	6.40	.77	9.75	.90	7.42	.99	8.06
	19	.61	9.75	.72	9.75	.80	6.87	.89	7.42
30	1	.45	6.40	.64	6.40	.65	10.89	.80	8.83
	7	.48	8.83	.61	9.75	*			
	13	*		*		.62	6.40	.72	9.75
	19	.51	8.06	.59	7.42	.69	9.75	.83	8.83
MEAN		.57	7.99	.61	10.30	.78	8.73	.88	8.33
STD		.23	2.88	.24	2.56	.29	2.30	.32	2.10

*=Electronic problems

4 CERC Gage Number 630, Waverider 6 km from shore

3



CERC Gage Number 640, Waverider 1 km from shore

4

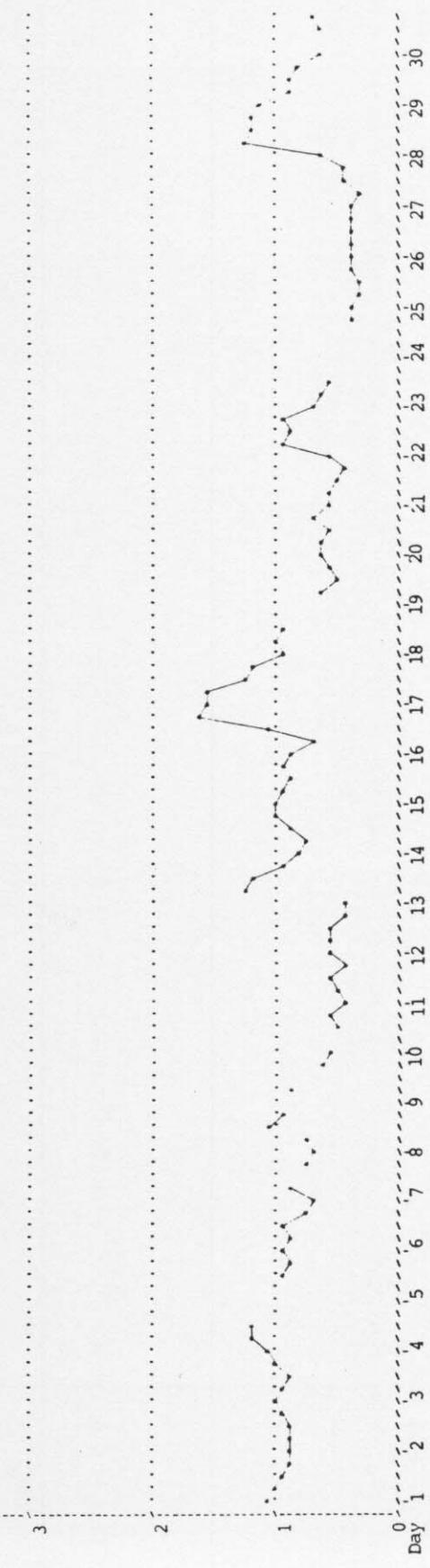
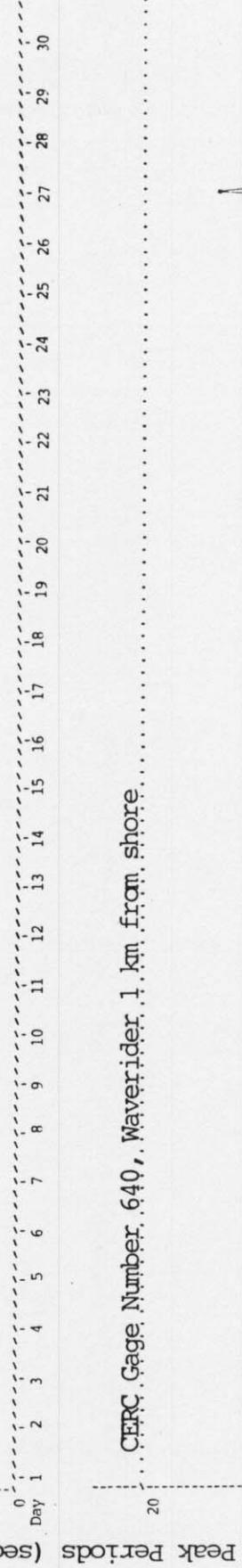
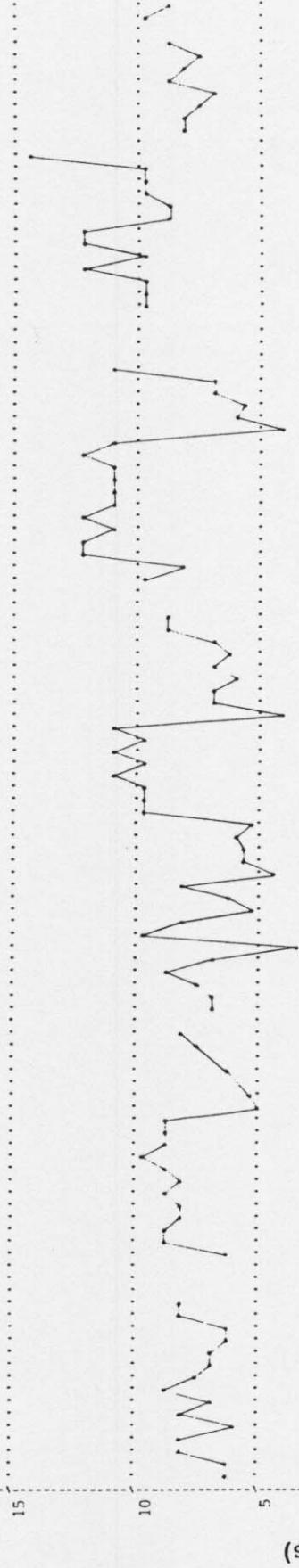


FIGURE 3. Time History of Wave Heights and Periods - September 1986 Part I: Heights

CERC. Gage Number. 630, Waverider. 6 km. from shore

20



CERC Gage Number. 640, Waverider. 1 km. from shore

20

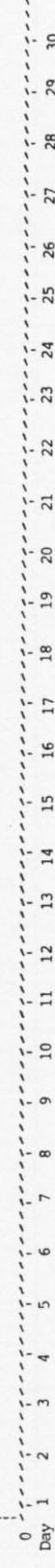
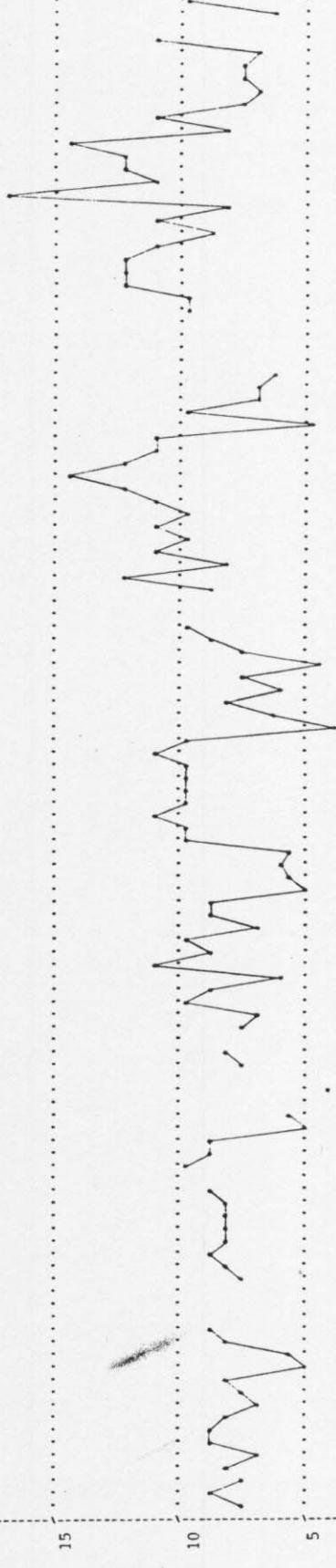


FIGURE 3. Time History of Wave Heights and Periods - September 1986 Part II: Periods

IV. CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: CURRENT DATA
(SPEEDS IN CM/SEC)
September 1986

TIME	SPEED	DIR	PIER MEASUREMENTS			BEACH MEASUREMENTS			CURRENT METER		
			DYE AT 19+00 (579m) (SURFACE)			DYE AT MID-SURF ZONE (SURFACE) DIST. FROM			DYE 12M OFFSHORE (SURFACE)		
			BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR	
0100-Alongshore											5 S
Cross-shore											6 OF
Resultant											8 110
0700-Alongshore	28	S					61	S			18 S
Cross-shore	7	On					152	On			11 OF
Resultant	29	179					63	174			21 130
1300-Alongshore											4 S
Cross-shore											5 OF
Resultant											7 110
1900-Alongshore											3 S
Cross-shore											2 OF
Resultant											4 113
0100-Alongshore											5 S
Cross-shore											4 OF
Resultant											5 112
0700-Alongshore	3	S					32	N			8 S
Cross-shore	3	On					140	10	Off		5 OF
Resultant	5	205					33	352			10 126
1300-Alongshore											7 S
Cross-shore											6 OF
Resultant											9 117
1900-Alongshore											5 S
Cross-shore											5 OF
Resultant											7 117
0100-Alongshore											2 N
Cross-shore											4 OF
Resultant											4 48
0700-Alongshore	5	N					36	N			2 S
Cross-shore	2	On					150	13	Off		4 OF
Resultant	5	321					38	359			5 95
1300-Alongshore											2 S
Cross-shore											6 OF
Resultant											6 89
1900-Alongshore											2 S
Cross-shore											4 OF
Resultant											5 24
0100-Alongshore											10 S
Cross-shore											7 OF
Resultant											12 122
0700-Alongshore	20	S					76	N			14 S
Cross-shore	5	On					140	0	0		4 OF
Resultant	21	174					76	340			15 143
1300-Alongshore											9 S
Cross-shore											1 0N
Resultant											9 169
1900-Alongshore											11 S
Cross-shore											5 OF
Resultant											12 134
0100-Alongshore											9 S
Cross-shore											5 OF
Resultant											10 132
0700-Alongshore	0	0					10	N			7 S
Cross-shore	0	0					140	17	Off		4 OF
Resultant	0	0					20	40			8 132
1300-Alongshore											6 S
Cross-shore											7 OF
Resultant											9 113
1900-Alongshore											5 N
Cross-shore											2 OF
Resultant											5 5
0100-Alongshore											3 N
Cross-shore											4 OF
Resultant											6 33
0700-Alongshore	10	S					30	N			5 N
Cross-shore	6	On					140	15	Off		5 OF
Resultant	12	191					34	7			7 25
1300-Alongshore											3 S
Cross-shore											8 OF
Resultant											9 23
1900-Alongshore											6 N
Cross-shore											3 OF
Resultant											6 10

KEY = ALL SPEEDS IN CM/SEC
N = NORTHWARD, SHORE PARALLEL
S = SOUTHWARD, SHORE PARALLEL
ON=ONSHORE
OF=OFFSHORE

DAY	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500 UPDRIFT)			CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679
		DYE AT 19+00 (579m) (SURFACE)	DYE AT MID-SURF ZONE (SURFACE)	DYE DIST. FROM 12M OFFSHORE (SURFACE)	CURRENT METER AT SOUTH TRIPOD			
		SPEED DIR	BASELINE(M)	SPEED DIR	LOCATION	SPEED DIR	SPEED	
7	0100-Alongshore						1	S
	Cross-shore						6	OF
	Resultant						6	83
7	0700-Alongshore	5 N					2	S
	Cross-shore	2 On		140 55 N		27 N	6	OF
	Resultant	6 318		0 0	South		6	86
7	1300-Alongshore						16	S
	Cross-shore						9	OF
	Resultant						18	131
7	1900-Alongshore						9	S
	Cross-shore						7	OF
	Resultant						11	122
8	0100-Alongshore						11	S
	Cross-shore						6	OF
	Resultant						13	130
8	0700-Alongshore	5 S					7	S
	Cross-shore	2 Off		140 61 N		36 N	6	OF
	Resultant	6 138		0 0	South		9	118
8	1300-Alongshore						25	S
	Cross-shore						9	OF
	Resultant						22	139
8	1900-Alongshore						15	S
	Cross-shore						8	OF
	Resultant						17	131
9	0100-Alongshore						12	S
	Cross-shore						9	OF
	Resultant						15	125
9	0700-Alongshore	21 S					11	S
	Cross-shore	5 On		152 34 S		32 S	9	OF
	Resultant	22 174		34 Off	North		14	121
9	1300-Alongshore						16	S
	Cross-shore						11	OF
	Resultant						19	127
9	1900-Alongshore						11	S
	Cross-shore						9	OF
	Resultant						14	112
10	0100-Alongshore						10	S
	Cross-shore						11	OF
	Resultant						15	111
10	0700-Alongshore	4 N					2	S
	Cross-shore	9 On		152 67 N		27 N	8	OF
	Resultant	9 47		0 0	South		8	82
10	1300-Alongshore						2	N
	Cross-shore						9	OF
	Resultant						10	56
10	1900-Alongshore						10	N
	Cross-shore						5	OF
	Resultant						11	9
11	0100-Alongshore						1	N
	Cross-shore						4	OF
	Resultant						4	62
11	0700-Alongshore	14 S					1	S
	Cross-shore	4 On		154 15 N		34 S	6	OF
	Resultant	14 177		4 Off	South		6	76
11	1300-Alongshore						5	OF
	Cross-shore						5	70
	Resultant						5	N
11	1900-Alongshore						4	OF
	Cross-shore						7	18
12	0100-Alongshore						1	N
	Cross-shore						3	OF
	Resultant						3	53
12	0700-Alongshore	32 N					3	N
	Cross-shore	18 Off		152 61 N		33 N	2	OF
	Resultant	37 9		3 Off	South		4	23
12	1300-Alongshore						3	N
	Cross-shore						3	OF
	Resultant						5	28
12	1900-Alongshore						2	S
	Cross-shore						6	OF
	Resultant						6	23

KEY = ALL SPEEDS IN CM/SEC
 N =NORTHWARD, SHORE PARALLEL
 S =SOUTHWARD, SHORE PARALLEL
 ON=ONSHORE
 OF=OFFSHORE

DAY	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500 UPDRIFT)			CURRENT METER AT SOUTH TRIFOLI (DEPTH -4.8m MSL) I.D.#679	
		DYE AT 19+00 (579m) (SURFACE)	DYE AT MID-SURF ZONE (SURFACE)	DYE 12M OFFSHORE DIST. FROM (SURFACE)	BASELINE(M)	SPEED	DIR		
13	0100-Alongshore							2	5
	Cross-shore							5	OF
	Resultant							6	90
13	0700-Alongshore	34 S			102 S			5	
	Cross-shore	17 On			176 30 On	North	11 S	10	OF
	Resultant	38 187			106 177			24	135
13	1300-Alongshore							19	S
	Cross-shore							9	OF
	Resultant							21	133
13	1900-Alongshore							19	S
	Cross-shore							5	OF
	Resultant							21	134
14	0100-Alongshore							13	S
	Cross-shore							8	OF
	Resultant							16	128
14	0700-Alongshore	17 S			25 S			16	S
	Cross-shore	2 On			154 6 Off	North	27 S	10	OF
	Resultant	18 166			26 146			19	127
14	1300-Alongshore							16	S
	Cross-shore							11	OF
	Resultant							19	126
14	1900-Alongshore							20	S
	Cross-shore							11	OF
	Resultant							22	132
15	0100-Alongshore							17	S
	Cross-shore							12	OF
	Resultant							21	125
15	0700-Alongshore	7 S			23 N			19	S
	Cross-shore	2 On			152 0 0	North	51 S	14	OF
	Resultant	7 177			23 340			24	124
15	1300-Alongshore							4	S
	Cross-shore							12	OF
	Resultant							12	86
15	1900-Alongshore							4	S
	Cross-shore							4	OF
	Resultant							6	111
16	0100-Alongshore							0	
	Cross-shore							3	OF
	Resultant							3	70
16	0700-Alongshore	21 N			61 N			2	N
	Cross-shore	11 Off			140 0 6	South	74 N	5	OF
	Resultant	24 7			61 340			5	43
16	1300-Alongshore							17	S
	Cross-shore							9	OF
	Resultant							19	131
16	1900-Alongshore							27	S
	Cross-shore							10	OF
	Resultant							22	139
17	0100-Alongshore							25	S
	Cross-shore							9	OF
	Resultant							27	140
17	0700-Alongshore	47 S			122 S			30	S
	Cross-shore	0 0			152 18 On	North	88 S	11	OF
	Resultant	47 160			123 169			32	141
17	1300-Alongshore							28	S
	Cross-shore							9	OF
	Resultant							30	142
17	1900-Alongshore							23	S
	Cross-shore							9	OF
	Resultant							25	138
18	0100-Alongshore							16	S
	Cross-shore							8	OF
	Resultant							18	133
18	0700-Alongshore	15 S			23 N			18	S
	Cross-shore	5 On			152 47 Off	South	33 N	8	OF
	Resultant	15 179			52 43			20	135
18	1300-Alongshore							12	S
	Cross-shore							8	OF
	Resultant							15	126
18	1900-Alongshore								
	Cross-shore								
	Resultant								

KEY = ALL SPEEDS IN CM/SEC
 N =NORTHWARD, SHORE PARALLEL
 S =SOUTHWARD, SHORE PARALLEL
 ON=ONSHORE
 OF=OFFSHORE

DAY	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500 UPDRIFT)			CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) D. #679
		DYE AT 19+00 (579m) (SURFACE)	DYE AT MID-SURF ZONE (SURFACE) DIST. FROM	DYE 12M OFFSHORE (SURFACE)				
19	0100-Alongshore							
	Cross-shore							
	Resultant							
19	0700-Alongshore	16 N		68 N				
	Cross-shore	6 Off		10 Off				
	Resultant	17 2		68 349				
19	1300-Alongshore							
	Cross-shore							
	Resultant							
19	1900-Alongshore							
	Cross-shore							
	Resultant							
20	0100-Alongshore							
	Cross-shore							
	Resultant							
20	0700-Alongshore	10 N		15 N				
	Cross-shore	0 0		4 Off				
	Resultant	64 340		16 354				
20	1300-Alongshore							
	Cross-shore							
	Resultant							
20	1900-Alongshore							
	Cross-shore							
	Resultant							
21	0100-Alongshore							
	Cross-shore							
	Resultant							
21	0700-Alongshore	32 N		15 N				
	Cross-shore	2 On		4 Off				
	Resultant	32 337		15 354				
21	1300-Alongshore							
	Cross-shore							
	Resultant							
21	1900-Alongshore							
	Cross-shore							
	Resultant							
22	0100-Alongshore							
	Cross-shore							
	Resultant							
22	0700-Alongshore	20 S		51 S				
	Cross-shore	15 On		0 0				
	Resultant	25 197		51 160				
22	1300-Alongshore							
	Cross-shore							
	Resultant							
22	1900-Alongshore							
	Cross-shore							
	Resultant							
23	0100-Alongshore							
	Cross-shore							
	Resultant							
23	0700-Alongshore	4 S		17 S				
	Cross-shore	0 0		8 On				
	Resultant	4 160		19 187				
23	1300-Alongshore							
	Cross-shore							
	Resultant							
23	1900-Alongshore							
	Cross-shore							
	Resultant							
24	0100-Alongshore							
	Cross-shore							
	Resultant							
24	0700-Alongshore	20 N		28 N				
	Cross-shore	6 Off		7 S				
	Resultant	21 357		29 354				
24	1300-Alongshore							
	Cross-shore							
	Resultant							
24	1900-Alongshore							
	Cross-shore							
	Resultant							

KEY = ALL SPEEDS IN CM/SEC
 N =NORTHWARD, SHORE PARALLEL
 S =SOUTHWARD, SHORE PARALLEL
 ON=ONSHORE
 OF=OFFSHORE

DAY:	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500' UPDRIFT)			CURRENT METER AT SOUTH TRIPOD
		DYE AT 19+00 (579m) (SURFACE)	DYE AT MID-SURF ZONE (SURFACE) DIST. FROM	DYE 12M OFFSHORE (SURFACE)	(DEPTH -4.8m MSL) I.D.#679			
25	0100-Alongshore Cross-shore Resultant							4 S
25	0700-Alongshore Cross-shore Resultant	0 0		140 68 N	0 0	South 15 S	3 OF	5 123
25	1300-Alongshore Cross-shore Resultant	14 Off			68 340		3 70	5 S
25	1900-Alongshore Cross-shore Resultant	14 70					5 160	5 S
26	0100-Alongshore Cross-shore Resultant						9 5	5 OF
26	0700-Alongshore Cross-shore Resultant	0 0		152 0 0	0 0	South 3 N	10 134	10 S
26	1300-Alongshore Cross-shore Resultant	15 Off			0 0		12 124	9 OF
26	1900-Alongshore Cross-shore Resultant	15 160					15 127	9 S
27	0100-Alongshore Cross-shore Resultant						9 88	9 OF
27	0700-Alongshore Cross-shore Resultant	5 S		140 17 N	0 0	South 6 N	11 150	11 S
27	1300-Alongshore Cross-shore Resultant	3 Off			17 340		12 145	1 150
27	1900-Alongshore Cross-shore Resultant	6 129					5 109	5 S
28	0100-Alongshore Cross-shore Resultant						1 109	1 109
28	0700-Alongshore Cross-shore Resultant	17 S		152 102 N	0 0	North 46 S	16 133	14 OF
28	1300-Alongshore Cross-shore Resultant	0 0			102 340		8 133	14 S
28	1900-Alongshore Cross-shore Resultant	17 160					18 146	14 OF
29	0100-Alongshore Cross-shore Resultant						15 103	15 S
29	0700-Alongshore Cross-shore Resultant	15 S		152 102 N	15 On	South 44 N	6 133	11 OF
29	1300-Alongshore Cross-shore Resultant	8 On			102 331		20 130	10 S
29	1900-Alongshore Cross-shore Resultant	17 187					18 143	10 OF
29	0100-Alongshore Cross-shore Resultant						17 136	17 S
29	0700-Alongshore Cross-shore Resultant	15 S		152 102 N	15 On	South 44 N	6 136	5 OF
29	1300-Alongshore Cross-shore Resultant	8 On			102 331		20 130	5 S
29	1900-Alongshore Cross-shore Resultant	17 187					18 143	18 S
30	0100-Alongshore Cross-shore Resultant						1 340	1 340
30	0700-Alongshore Cross-shore Resultant	12 N		149 102 N	10 Off	South 50 N	4 N	0 ON
30	1300-Alongshore Cross-shore Resultant	22 Off			102 346		1 340	1 340
30	1900-Alongshore Cross-shore Resultant	25 43					5 323	5 323
30	0100-Alongshore Cross-shore Resultant						12 N	12 N
30	0700-Alongshore Cross-shore Resultant						0 340	0 340
30	1300-Alongshore Cross-shore Resultant						1 340	1 340
30	1900-Alongshore Cross-shore Resultant						7 N	7 N
							7 OF	7 OF
							7 347	7 347

KEY = ALL SPEEDS IN CM/SEC
 N =NORTHWARD, SHORE PARALLEL
 S =SOUTHWARD, SHORE PARALLEL
 ON=ONSHORE
 OF=OFFSHORE

V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

TABLE 5
SUPPLEMENTAL OBSERVATIONS

SEP 1986

DAY	TIME	WAVE APPROACH ANGLE:			WATER CHARACTERISTICS				
		AT PIER END deg from True N	RADAR WAVE ANGLE deg	WIDTH OF SURF ZONE(m)	TEMP(C)	AT PIER END DENSITY(g/cc)	SECCI	VIS(m)	
1	740	80		95	84	22.3	1.0204	1.2	
2	604	80	60	80	76	22.5	1.0204	1.5	
3	704	95	45		84	23.0	1.0204	2.4	
4	616	80		80	87	23.1	1.0201	1.5	
5	605	90		90	67	23.2	1.0208	1.2	
6	608	90		80	79	23.8	1.0210	2.1	
7	610	80		80	78	23.8	1.0208	2.1	
8	718	90		85	76	24.0	1.0211	2.4	
9	605	60	80	80	91	22.7	1.0212	2.1	
10	705	90		80	64	22.7	1.0206	2.4	
11	700	80		75	55	22.7	1.0208	3.0	
12	620	135			61	22.1	1.0220	3.4	
13	700	20		40	119	22.1	1.0222	1.5	
14	805	20	105		70	21.8	1.0224	2.7	
15	627	100		90	79	22.2	1.0212	2.1	
16	654	100		80	58	22.3	1.0222	1.5	
17	630	50	60	50	137	21.3	1.0225	1.2	
18	734	50	75		88	20.7	1.0224	0.9	
19	600	105			52	21.2	1.0224	1.2	
20	600	90			18	21.5	1.0224	1.8	
21	610	75		inoperative	61	21.5	1.0218	2.1	
22	748	40	50	60	75	22.1	1.0222	0.9	
23	647	55			72	22.0	1.0218	3.0	
24	557	80			55	22.3	1.0222	1.5	
25	619	100			41	22.0	1.0221	1.2	
26	735	120			21	23.4	1.0220	1.8	
27	541	90			52	25.5	1.0216	1.2	
28	700	40		60	123	24.2	1.0208	0.9	
29	649	90		90	91	24.3	1.0203	1.2	
30	715	125			55	23.7	1.0214	3.4	

VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865- 1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

FRF TIDE HEIGHTS

SEP 1986

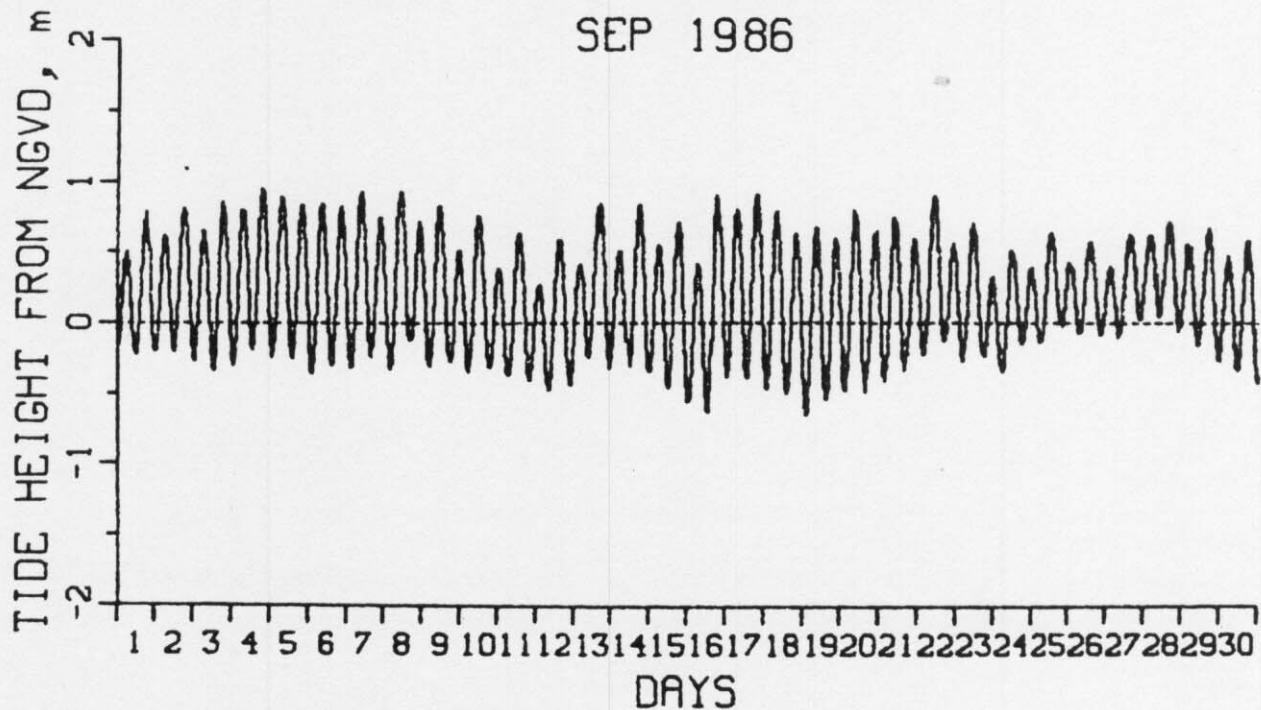


FIGURE 4. Time History of Mean Water Levels, September 1986 (Gage No. 865-1370)

MONTHLY MEAN WATER LEVELS (METERS MSL)

Extreme Low -	-0.65 on 19 September at 0130 hrs.
Extreme High -	0.94 on 4 September at 1906 hrs.
Monthly Mean -	0.19
Mean Low Water -	-0.30
Mean High Water -	0.67
Mean Range -	0.98

TABLE 6
WATER LEVELS (METERS MSL)
Tidal Characteristics

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-0.22	0.50	0.11	0.72
2	703	-0.20	0.62	0.23	0.82
2	1929	-0.27	0.90	0.29	1.09
3	752	-0.33	0.65	0.17	0.98
3	2018	-0.31	0.95	0.28	1.16
4	843	-0.20	0.80	0.29	0.99
4	2109	-0.24	0.94	0.37	1.15
5	934	-0.26	0.89	0.32	1.14
5	2159	-0.25	0.83	0.24	1.19
6	1024	-0.31	0.84	0.26	1.15
6	2249	-0.32	0.81	0.24	1.13
7	1115	-0.24	0.91	0.33	1.16
7	2340	-0.33	0.74	0.22	1.07
8	1205	-0.12	0.92	0.38	1.04
9	30	-0.31	0.70	0.20	1.01
9	1255	-0.28	0.82	0.27	1.10
10	121	-0.35	0.51	0.09	0.95
10	1346	-0.32	0.75	0.23	1.07
11	211	-0.37	0.37	0.00	0.75
11	1436	-0.41	0.63	0.15	1.04
12	301	-0.47	0.27	-0.09	0.73
12	1527	-0.44	0.59	0.12	1.02
13	1617	-0.33	0.94	0.32	1.16
14	1707	-0.35	0.83	0.26	1.18
15	532	-0.46	0.55	0.07	1.01
15	1758	-0.56	0.71	0.11	1.27
16	623	-0.63	0.41	-0.09	1.04
16	1848	-0.45	0.89	0.23	1.35
17	713	-0.39	0.90	0.22	1.19
17	1938	-0.47	0.91	0.25	1.38
18	804	-0.51	0.78	0.14	1.29
18	2029	-0.65	0.64	0.01	1.29
19	954	-0.55	0.67	0.05	1.22
19	2119	-0.48	0.59	0.04	1.08
20	944	-0.49	0.90	0.17	1.29
20	2210	-0.42	0.64	0.10	1.06
21	1035	-0.33	0.74	0.21	1.07
21	2300	-0.22	0.60	0.15	0.82
22	1125	-0.12	0.99	0.37	1.01
22	2350	-0.27	0.55	0.15	0.82
23	1216	-0.24	0.71	0.22	0.95
24	41	-0.35	0.32	-0.02	0.67
24	1306	-0.18	0.51	0.15	0.69
25	131	-0.14	0.39	0.11	0.53
25	1356	-0.02	0.64	0.30	0.66
26	222	-0.06	0.42	0.18	0.48
26	1447	-0.09	0.57	0.27	0.66
27	312	-0.10	0.40	0.14	0.50
27	1537	0.01	0.62	0.33	0.62
28	402	0.04	0.62	0.24	0.59
29	1629	-0.05	0.71	0.35	0.77
29	1718	-0.27	0.67	0.23	0.94
30	543	-0.34	0.48	0.07	0.93

VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in August and the two surveys in September on profile line 188, located 517 m south of the pier. Minor changes to the profile include a slight reduction in the size of the nearshore bar (120 to 200 m) and a 20 m shoreward migration of the storm bar (280 to 320 m). In addition, a small berm developed on the foreshore (80 to 120 m).

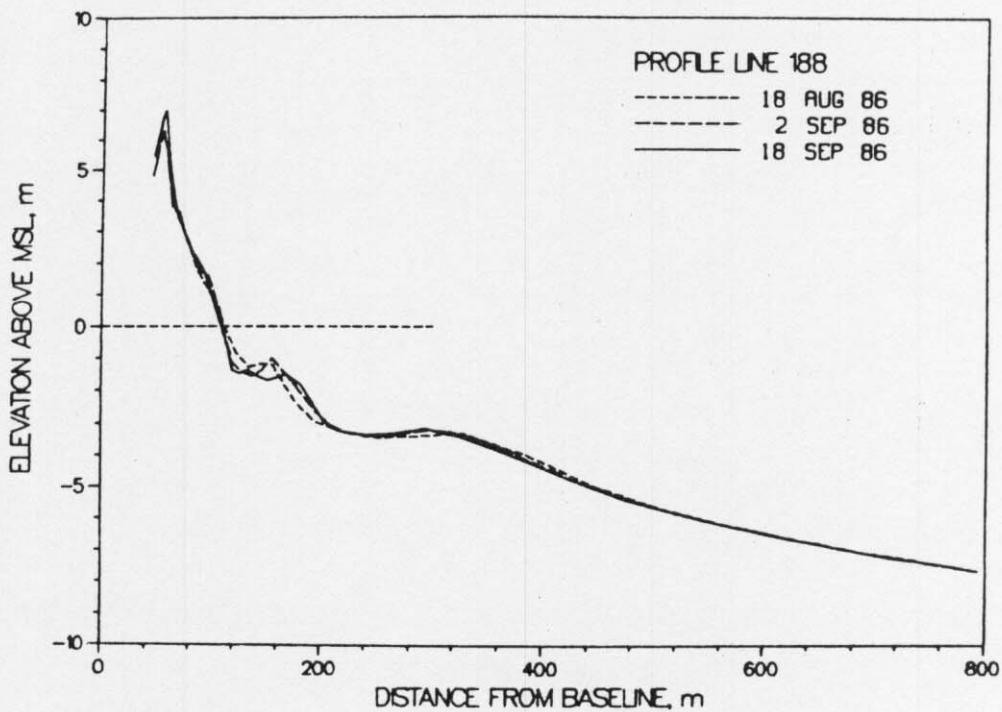


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes which occurred on the profile between January and September. The only visible change (160 m) reflects the presence of a steep nearshore bar during the first survey in September.

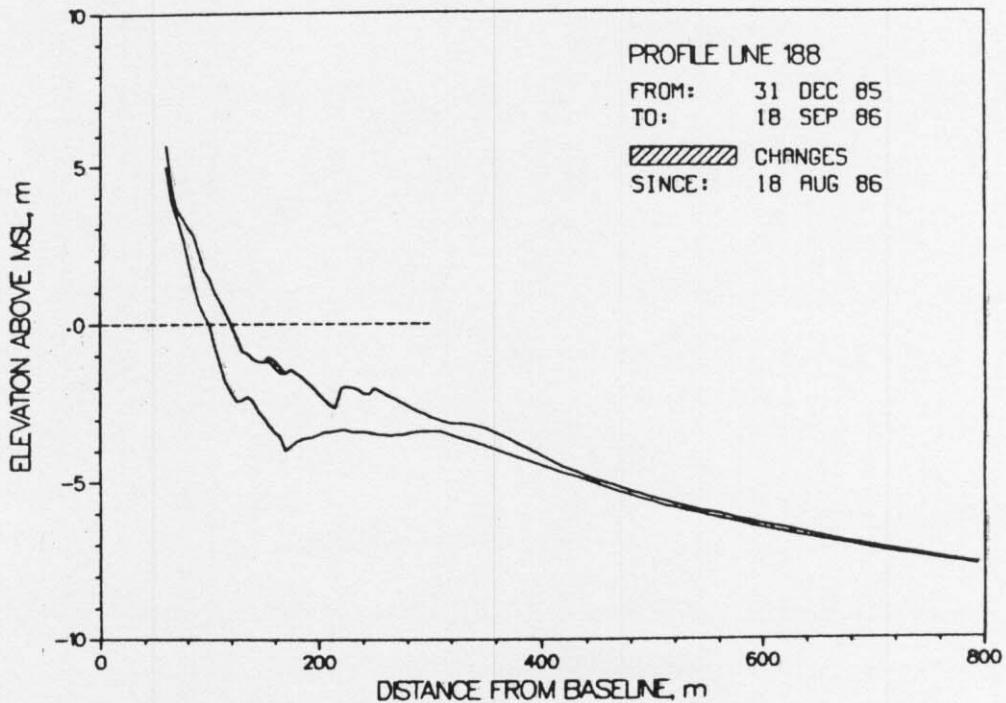


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. This month's bathymetric survey (Figure 7) completed on 3 September shows relatively straight and parallel contours away from the trough under the pier. In depths of -1.5 to -2.0 m, the contours show some rhythmic variation. In comparison to the previous survey completed on 23 July, the seaward movement of the inner bar occurred uniformly along most of the shoreline and resulted in up to 1 m of deposition approximately 150 m from the baseline. Erosion occurred landward of the bar and in the trough under the pier.

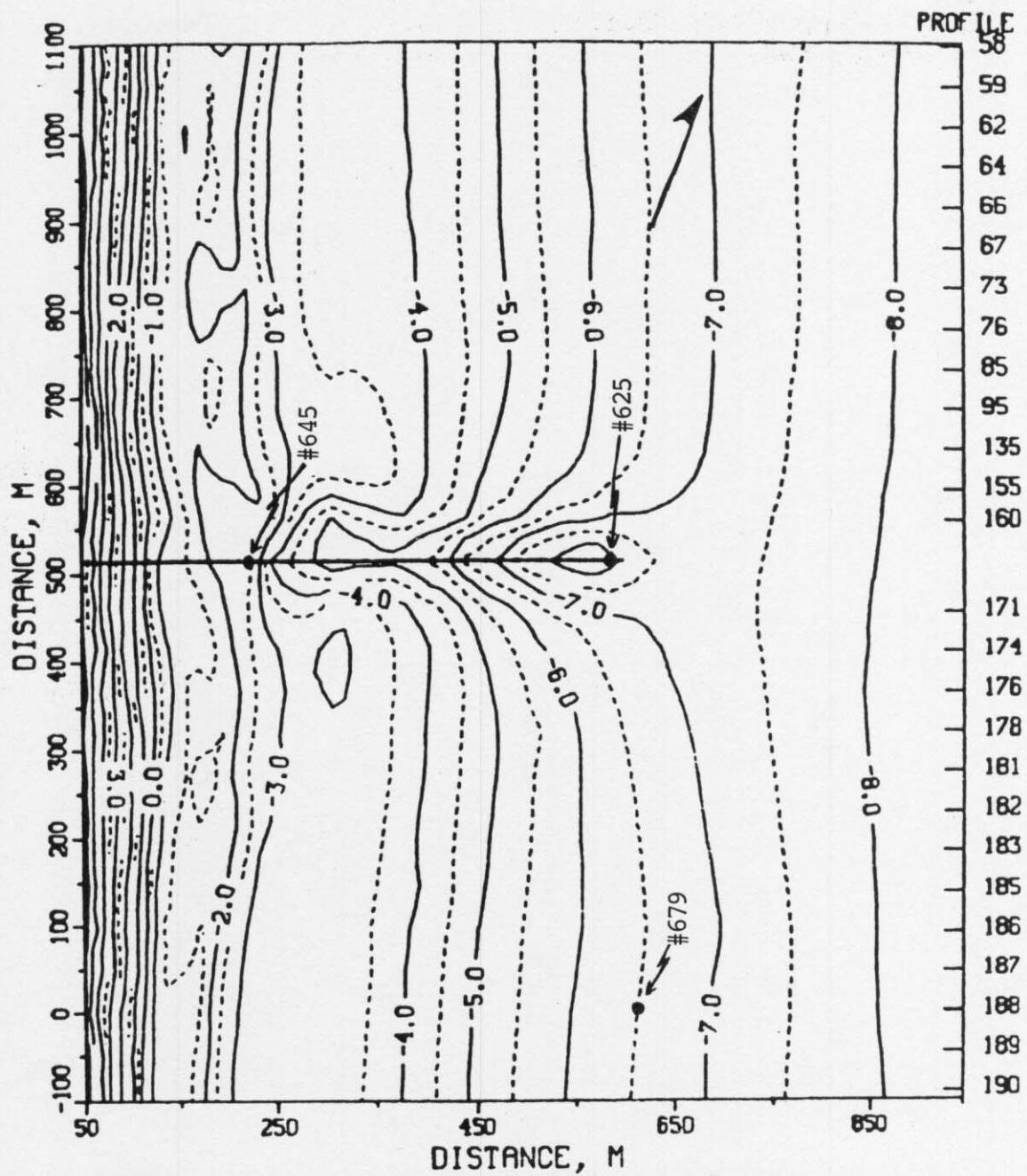


Figure 7. FRF BATHYMETRY 3 SEP 86
CONTOURS IN METERS

Distribution List

Government Agencies:

OCE
BERH
NAO
NASA/Wallops Flight Center
NOAA (NOS, NWS)
SAD
SAW

U.S. Geological Survey
U.S. National Park Service
U.S. Naval Academy
U.S. Naval Civil Eng. Lab
U.S. Naval Fac. Eng. Com.
U.S. Naval Oceanographic Off.
U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.
East Carolina University
Florida Inst. of Tech.
Naval Post Graduate School
NC State University
Old Dominion University
Oregon State University
Prince George's College
Rutgers University
Scripp Inst. of Oceanography
Southern Illinois University

Stockton State College
University of Akron
University of Delaware
University of Florida
University of Maryland
University of Miami
University of North Carolina
University of N. Colorado
University of Rhode Island
University of Virginia
Va. Inst. of Marine Science

Others:

City of Va. Beach, VA
Coastal Barge Corporation
Coastal and Est. Res., Inc.
Coastal Science & Eng., Inc.
Dr. Galvin
GEOMET Tech., Inc.
Greenhorne & O'Mara, Inc.
Dr. Hylton
Mary Marr, Inc.
Masonite Corporation
MEC Systems Corporation

Moffatt & Nichol, Eng.
Offshore Coastal Technologies
Mr. Rowland
Mr. Savage
Sea Port Supply Corp.
Shell Development
Sherwood Industries
Sohio Petroleum Co.
Mr. & Mrs. Valpey
WCTI-TV

Foreign:

W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
Queen's University, Ontario (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of New South Wales (Australia)
University of Sydney (Australia)